

XII.—*Critical Notes on the Polyzoa.* By the Rev. THOMAS HINCKS, B.A., F.R.S.

Part II.\*—CLASSIFICATION.

1. *Preliminary Section.*

MANY years have now elapsed since the publication of Smitt's fruitful work on the Scandinavian Polyzoa †, in which a new basis of classification was proposed and the foundations of a natural system were sought, not in the comparatively trivial variations of colonial growth and habit, but in the more significant and essential characters of the individual zoecium. When it is remembered that the older classifications were founded primarily, without exception, on zoarial peculiarities, we can feel little surprise that the proposals of the Swedish naturalist, discrediting as they did the fundamental principle on which they rested, were at first regarded as too revolutionary in character, and failed to produce any immediate effect on the systematic treatment of the Polyzoa. Probably, too, the fact that his great work, containing a singularly able and exhaustive account of his researches and theoretical views, is written in the Swedish language may help to account for the comparatively long period during which its specific claim was almost unrecognized and its influence but slightly felt. Certain it is that so late as 1880, when my 'History of the British Marine Polyzoa' was published, the principal writers on the Class gave at least a nominal adherence to the old views, and that in no systematic work had Professor Smitt's principles been adopted and applied.

To estimate rightly the work which the Swedish naturalist has accomplished in this department of zoology we must remember that it is not a mere revision of an existing system that we owe to him, but the institution of a new system, resting on new foundations, and implying a new interpretation of the facts with which it deals. His distinctive merit is that he substituted zoecial for colonial characters as the proper basis of a natural arrangement, thus giving a new direction to research and preparing the way for a system which

\* Part I. was published in the 'Annals' for February 1887.

† "Kritisk förteckning öfver Skandinaviens Hafs-Bryozoer," Öfvers. af Kongl. Vetenskaps-Akad. Förhandlingar, 1864-67. In 1867 the principles on which his classification was founded were discussed in a paper entitled "Bryozoa Marina in regionibus arcticis et borealibus viventia, recensuit F. Å. Smitt," Öfvers. K. Vet.-Akad. Förh. 1867, no. 6.

should rest not on mere superficial resemblances, but on genetic affinity.

The details of his classification—his definitions of genera, his identifications of species, his grouping of varietal forms, and other points—may be open in some cases to criticism and revision; but it may be safely affirmed that he has indicated the direction which all sound and fruitful research must take for the future\*.

Within the last few years there has been a very general acceptance of Prof. Smitt's fundamental principle amongst students of the Polyzoa, though there are still serious diversities of opinion as to the zoöcial elements which possess the highest systematic value, and we must await the results of yet further investigation before we may hope to realize a perfect system. In the meantime it may be useful to indicate the nature and scope of some of the differences which exist amongst writers on the Polyzoa, and endeavour to estimate our actual position with reference to systematic questions.

Amongst those who in recent times have occupied themselves with these questions I may name Jullien†, Koschinsky‡, and Pergens and Meunier§. Waters too, in his numerous papers (chiefly on fossil forms) and in his supplementary notes on the 'Challenger' Polyzoa, has given us many interesting suggestions bearing on systematic points which merit careful consideration. To some of these I hope to refer hereafter.

All these writers are agreed in seeking the basis of classification amongst the characters of the zoöcium, so far at least as the Cheilostomata are concerned. Pergens and Meunier adopt in great part, though only provisionally, the revision

\* It must be remarked here that Smitt did not carry out his principle in the arrangement of the Cyclostomata. He says, "Formæ vero Cyclostomatum sicut in antiquioribus geologiæ temporibus maxime floruerunt, sic etiam inferiorem evolutionis gradum retinuerunt, ita ut, quamvis variis figuris coloniarum abundet hic ordo, zoöcia fere æqualia præbeat" ("Bryozoa Marina in regionibus arcticis et borealibus viventia," *Öfversigt af Kongl. Vetensk.-Akad. Förhandl.* 1867, no. 6, p. 467.

† "Note sur une nouvelle division des Bryozoaires Cheilostomiens," *Bulletin de la Soc. Zool. de France*, t. vi. (1881); "Monographie des Bryozoaires d'eau douce," *ibid.* t. x. (1885); "Les Costulidées, nouvelle Famille de Bryozoaires," *ibid.* t. xi. (1886); "Mission du Cap Horn, Bryozoaires."

‡ "Ein Beitrag zur Kenntniss der Bryozoen-Fauna der älteren Tertärschichten des südlichen Bayerns," i. Abtheil., Cheilostomata. *Palæontographica*, herausgegeben von Karl A. von Zittel, Band xxxii. Erste Lieferung, 1885.

§ "La Faune des Bryozoaires Garumniens de Faxe," *Ann. de la Soc. Malacologique de Belgique*, tom. xxi. (1886) pp. 12, 13.

and extension of Smitt's system, which I have embodied in my 'History' of the British species. They take exception at the same time to the importance assigned to the zoöcial orifice, which (they hold) is liable in many species to remarkable variations and cannot be regarded as a stable character. They say:—"Celui-ci (l'orifice zoöcial) présente dans beaucoup d'espèces des différences remarquables, et substituer une classification basée principalement sur le seul caractère de cette ouverture à celle qui avait principalement en vue la forme de la colonie, c'est remplacer une classification artificielle par une autre, toujours moins éloignée de la réalité. On ignore encore quels sont les caractères réellement stables dans les Cheilostomes aussi bien que dans les Cyclostomes" \*. They add, "Dans ces derniers (Cyclostomes) presque tout est encore à faire; dans les premiers, M. Hincks s'attache presque exclusivement à la forme de l'orifice zoöcial."

Upon this I would remark that the latter statement can hardly be accepted as a correct representation of the actual fact. I have not relied by any means "exclusively" on the form of the orifice in forming genera, nor has it been as a matter of choice that I have in any case contented myself with a single character; much less can it be said with truth that it has been my purpose to make the zoöcial orifice, as a substitute for the colonial form, the basis of my classification. My primary object has been to give effect to the new systematic principle *in the best way which the actual state of our knowledge would permit*; and if in some cases the structure of the zoöcial orifice has been adopted singly as the basis of generic groups, it is simply because, from the imperfection of our knowledge, no other characters of equal stability and significance could be found. I will reproduce here the following passage from the "Introduction" to my 'History,' which has reference to this subject:—"What, then, are the most significant features of the zoöcium for classificatory purposes? Form, superficial sculpture, the presence or absence of spines or other appendages, these are generally too variable and inconstant to yield any sure criteria. But we may find such in the structural peculiarities of the cell—as, for instance, the modifications of the *aperture*, the degree in which the primitive opening is preserved or obliterated,

\* "La Faune des Bryozoaires Garummiens de Faxe," Ann. de la Soc. Roy. Malacologique de Belgique, tom. xxi. (1883). Mr. Walford has strangely misinterpreted the latter part of this passage and has given to one of its clauses a meaning the very opposite of that which the authors intended; see his paper on "Bryozoa from the Inferior Oolite," Quart. Journ. Geol. Soc. for August 1889.

the ribbed condition of the front wall (as in *Membraniporella* and *Cribrilina*), the chambered condition of the cavity (as in *Steganoporella*), &c. One of the most constant features of the zoecium, too, is to be found (as noticed long ago by Hassall) in the orifice, which exhibits a series of well-marked modifications, and has in some cases a developmental history, which affords the most valuable, because the most significant, characters" \*.

In point of fact a very considerable proportion of the Cheilostomatous genera which I have constituted or adopted are not based on "the form of the orifice." The following may be instanced in addition to those referred to in the above passage:—*Siphonoporella*, a Membraniporidan form characterized by a calcareous tubular structure attached to the lamina immediately below the aperture; *Euthyris*, also Membraniporidan, based on the structure of the operculum, which marks a distinct advance upon the typical *Membranipora*; *Micropora*, *Smittipora* (Jullien), *Thalamoporella*, *Setosella*; *Microporella*, founded on the form of the orifice in combination with the "special pore;" *Porina*, *Anarthropora*, *Mastigophora*; *Aspidostoma* and *Rhynchopora*, both based on the remarkable structures connected with the orifice, not on the mere form of it; *Stolonella*, allied to *Beania*, but having the membranous front-wall of the boat-shaped zoecium protected by modified spines, which are united so as to form a continuous covering. Others might be added, but these are amply sufficient to show that, although in certain leading groups the stress has undoubtedly been laid on the form of the orifice, as being at once the most stable and significant character at present available, there has been no intention of basing the classification generally (as in the old zoarial systems) on a single character.

As to the zoecial orifice, I believe that it has an intrinsic systematic value, and will probably always hold a distinct place as one of the criteria of affinity. In those sections at least of the Cheilostomata in which the oral opening has lost the primitive simplicity of the Membraniporidan type and is closed in by a solid frame, in which a well-organized operculum works on a distinct hinge, this structure has an undoubted significance of a very high order. Smitt, after an elaborate study of the modifications of the zoecial orifice and the relation between the principal forms of it, felt himself justified in assigning it the foremost place as a generic character. Even Jullien, who makes the "front-wall" the corner-stone of his system, admits the significance of the oral

\* Hist. Brit. Mar. Pol., Introduction, pp. cxxix, cxxx.

opening as a generic distinction and gives it a prominent place in his diagnosis. Koschinsky, in his very valuable paper on the Cheilostomata, gives it as his opinion emphatically that the form of the orifice is one of the most constant and available characters for classificatory purposes:—"Sehen wir von diesen und einigen anderen Fällen ab, so erweist sich die Form der Mundöffnung immerhin als eine der constantesten und brauchbarsten Merkmale" (*op. cit.* p. 9). Waters (Supplementary 'Challenger' Report, p. 3) has the following:—"Much has lately been written about classification, and some very unfortunate and premature attempts have been made at remodelling; established genera have been rechristened, and generic names given where it has been doubtful if specific were required. . . . As to my own position, I have repeatedly stated that, as far as the Cheilostomata are concerned, I consider an immense advance was made when the zoecial characters were put in the first rank, and believe that we are upon the right track; but none of us can suppose that there will not be much to alter as new facts are brought to light." I quite concur in these remarks. We are feeling our way as yet; but I believe, with Mr. Waters, that "we are on the right track," and that we shall more surely reach our goal by the patient accumulation of facts and the careful study of their significance than by premature and revolutionary change.

I have already quoted the passage in which Pergens and Meunier refer to the variability of the orifice in many species, and have pointed out the error into which they have fallen in supposing that there has been any intention of substituting a single-character classification of any kind for the old system founded on colonial form\*.

As to the alleged variability, there are no doubt cases in which differences of greater or less importance occur within the limits of a species. Some of these I have already pointed out elsewhere; but, so far as my experience goes, there is nothing exceptional in the amount of variability which occurs

\* Jullien also implies that the classification adopted by Smitt and (with modifications) by myself rests on "the form of the orifice" ('Note sur une nouvelle division des Bryozoaires Cheilostomiens,' p. 2). It does, of course, rest in part on this character and on the general structure of the orifice, but by no means as a whole. We have recognized a high significance in this character, but we have never proposed, so far as I know, to imitate the error of the older systematists, and base our system on a single structural feature. In a certain number of genera undoubtedly it has been made *the* diagnostic; but this, as I have already explained, is simply because no other character of equal significance, or, indeed, of any special significance at all, could be found at the time.



in the zoöcial orifice. Such appears to be Dr. Koschinsky's opinion. Smitt, from the use which he makes of this character in his classification, must have found reason for believing in its general constancy as well as in its significance. Granting a certain amount of variability, it is only what we might expect, for variability in greater or less degree is met with in every element of organic structure, and supplies the material, as we know, with which natural selection works in the evolution of new forms. It would be strange if any form of structure were free from variation; but in the case before us, so far as my observations enable me to judge, there is, as I have said, no special instability, but, on the contrary, a remarkable constancy.

In my 'History of the British Polyzoa' I have carefully noted the "range of variation" for a large proportion of the species. An analysis of the observations recorded under this heading will show that the zoöcial orifice is one of the most stable structural elements and that the amount of variation which it actually undergoes is for the most part trifling both in amount and significance. Of course this remark applies to the adult primary orifice.

In some species (belonging to various genera) there is a difference which may truly be called remarkable between the orifice of the ordinary and that of the ovicelliferous cells. Before an oöcium has made its appearance in the colony our attention is arrested by the presence of two dissimilar classes of zoöcia, in one of which (the less numerous) the orifice is not only of abnormal size, but of equally abnormal form. The latter will in time bear the ovicells and is modified with a view to this function. We have good illustrations of this peculiarity in *Cribrilina clithridata*, Waters, and *Schizoporella longirostrata*, Hincks. Of course this is not a case of varietal difference; the diversity of form is a specific character and for a special purpose. It is quite possible, however, that in the absence of the oöcia this twofold structure of the cells might be misinterpreted, and might be classed as one of the "remarkable differences" which go to prove the instability of the characters of the orifice; and I have therefore thought it well to direct attention to it here\*.

\* Smitt has noted the occurrence (in *Escharella rostrigera*) of larger zoöcia amongst the ordinary ones, exhibiting a great difference both in the form and size of the orifice. Oöcia, as far as he could see, were totally wanting, and he was unable to determine the physiological significance of the difference. We can have no doubt, with our present knowledge, that the larger zoöcia with the modified orifice were the zooids destined to bear the oöcia.

Dr. Jullien, in his paper on the "Costulidées" and his Cape-Horn Report, takes his stand on Smitt's fundamental principle. He thus defines his position:—"La classification que je me propose de suivre . . . a pour base fondamentale les caractères tirés de la *zoécie* isolée, depuis son origine jusqu'à son extrême vieillesse"\*. He proceeds to show that most of the recent writers on the *Polyzoa* (amongst whom he includes Busk, Smitt, Hincks, MacGillivray, and A. W. Waters) have followed the evil example of d'Orbigny, whilst giving their nominal adherence to the zoecial principle of classification. They have adopted the principle, but have been unable to recognize or weak enough to ignore its legitimate consequences. As an illustration of their inconsistency he refers to their treatment of the genera *Cellepora* and *Retepora*, which they retain as originally founded on merely zoarial characters.

Now Busk, it may be remarked in passing, never professed to deal in any serious way with the revision of the classification, the importance of which he must nevertheless have fully recognized. The descriptive portions of his 'Challenger' Report must have severely taxed his energies at his advanced age, and before it was concluded he had to bear the additional burthen of declining health. It is true he adopted and introduced into his work certain portions of the new classification; but rather, it would seem, in deference to the prevalent feeling in its favour than as the result of any independent and comprehensive study of the questions at issue. He would certainly have been the first to admit that his 'Report' does not embody a *consistent* system, and might probably have added that circumstances did not admit of his attempting to frame one. Its value lies in the extensive and accurate diagnosis and delineation of specific forms which it embodies, a kind of work which, in the present state of our knowledge, is of peculiar and primary importance.

As to the charge of inconsistency and want of thoroughness in giving effect to the fundamental principle of the new system on the part of those who introduced it, it may be admitted at once that there is a certain amount of truth in it. Under the peculiar conditions of the case I venture to think that this may be easily explained and was but natural. Indeed, it could hardly have happened otherwise.

The early application of new principles which contravene established modes of thought and strike at the root of venerable systems is apt to be somewhat hesitating and to savour more or less of compromise. Much of the pioneer work in

\* 'Mission du Cap Horn, Bryozoaires,' Introduction, p. 1.

such cases will be largely tentative in character. The full consequences of a new principle are not apprehended all at once, nor is it easy to cast off on the instant the yoke of old opinions, even when their foundations are shaken. All this is in the order of nature. It must be remembered, too, that there were serious difficulties in the way of arriving at a definite decision on many points at a time when the new systematic views had not as yet been thoroughly discussed nor their full significance appreciated. It seems to me, I confess, hardly just to make the hesitating step of those who were entering an untried region, and were unable to comprehend fully at first all the new conditions with which they had to deal, a matter of reproach. Their work has no doubt been a progressive one and has resulted in a much fuller and more thorough application of the new principle than they had realized at first. And I am far from denying that there are still oversights to be rectified and inconsistencies to be cancelled. Dr. Jullien finds one of the chief grounds for the charge of inconsistency which he brings against many of the later writers on the Polyzoa in their retention of the genera *Retepora* and *Cellepora*—artificial assemblages of species which, according to the new views, have no claim to be maintained. It is quite true that in my 'History' I have retained both these genera; but it is also true that in the case of *Retepora* I have pointed out the inadequacy of the fenestrate structure of the zoarium as the basis of a genus\*, and, remarking that the zoœcial characters of the British species are similar, have left the rest of the group to be dealt with after a fuller study of foreign species than was then possible. As to *Cellepora*, in retaining it I did so on the ground that there were zoœcial characters on which it might be founded. This opinion I have long since abandoned; but neither time nor opportunity has been available so far for the exhaustive examination of the numerous forms which have found a place in the Celleporine group, on which alone a reconstruction could be founded. The genera *Retepora* and *Cellepora* I regard, and have long regarded, as merely provisional.

\* "The reticulation is merely a form of ramification, and is probably entitled to no more systematic weight, apart from the characters of the zoœcium, than the simple branching, which was the distinction of the old genus *Eschara*. The retiform zoarium is associated with very different types of cell, whilst, on the other hand, a form in my possession . . . which cannot be distinguished generically, in other respects, from many of the *Retepore*, exhibits no trace whatever of reticulation. . . . Strongly marked as is the facies which its peculiar habit of growth gives to the *Retepore*, we must not assign too much weight to it as a clue to natural affinity." (Hist. Brit. Mar. Pol. i. p. 389.)



Professor Smitt, in his later writings, has dismembered them and distributed the species with which he deals amongst other groups\*.

After all, however, it matters little that the early expositors of the new systematic views did not see their way as clearly at first as they did subsequently. It may be admitted that they did not at once entirely renounce the principles "dont leur jeunesse a été imprégnée" (*Jullien*); but this will hardly be held to justify the summary way in which Dr. Jullien rejects their authority and supersedes their work. In the new classification of the Cheilostomata which he has proposed the whole of the existing families have disappeared with two exceptions †; the familiar names which have long held a place in the literature of the class have been swept away and a new coinage has taken their place.

This step, to say the least of it, must be accounted premature, and in the interest of science I venture to think is to be regretted.

Dr. Jullien himself has entered upon a course of investigation which may throw light on the minute structure of the Polyzoa and possibly on the true basis of a natural system. His interesting studies of the anatomy of the Cheilostomatous forms may be expected to disclose the significance of structural elements of which at present we know but little, and so guide us in our search for the evidences of natural affinity. It would certainly have been more satisfactory to receive from him a new system at the close of an extended course of such research rather than in its early stages.

Pergens and Meunier have emphasized the importance of anatomical and embryological research as a means of arriving at a natural classification, and are of opinion that the able investigators who have followed these lines of study have failed so far to solve the problem, because their researches have stopped short at the formation of the primary zoöcia. It may be so, but it is more probable that such studies may throw light on the affinities of the Class and the true basis of its higher divisions rather than on the constitution of family and generic groups, which must rest chiefly on the more apparent zoöcial characters.

\* Comparing *Escharoides rosacea* and *Retepora marsupiata*, he places them both in the same genus, and remarks:—"The difference in the form of the colonial growth cannot be of any generical value" (*Flor. Bryoz.* pt. 2, p. 68). I can find nothing to substantiate Dr. Jullien's statement respecting Smitt ("Note sur une nouvelle division &c.," *op. cit.* p. 2) that in his work on the Floridan Bryozoa "he relapses into the old errors."

† The Ceidæ of d'Orbigny and Aeteidæ of Hincks.

Dr. Pergens has recently published an important paper\* containing the results of his anatomical and developmental studies at the Zoological Station, Naples. He has had the opportunity of examining a large number of species with all the modern aids and appliances, and the paper is a valuable contribution to our knowledge of the Polyzoa. We are promised a continuation of it, which will be awaited with much interest. So far the results obtained do not appear to throw much new light on systematic questions; but if the observations recorded may be trusted, and they have evidently been made under the most favourable circumstances, with all care and full command of the newer methods of research, they will exclude several of Dr. Jullien's interpretations of structure, and notably his view of the nature and origin of the so-called pores in the cell-wall, which plays an important part in his proposed classification.

It would be impossible to examine the details of this classification within the limits of the present paper; but in the second section of it (on the *Cribrulinidæ*) I shall refer to the conception of the systematic significance of the zoecial front-wall, on which it is largely founded.

I pass on to consider briefly Dr. Jullien's strictures on another case of supposed departure from the true principle of zoecial classification. Some years since I instituted the genus *Barentsia* for the reception of a Pedicelline form, characterized by the concentration of muscular tissue at the base of the peduncle, as in the *Pedicellina gracilis*, Sars. Dr. Jullien contends that this genus is founded on zoarial and not, as it should be, on zoecial characters, and has therefore no claim to acceptance. Accordingly he disallows it, and restores the species which have been ranged under it to *Pedicellina* †. I venture to think that he has committed himself to a hasty judgment in this case, which he will find it difficult to maintain.

The distinctive character of the genus *Barentsia* is the remarkable modification of the muscular apparatus and the structural change in the peduncle which it involves.

The question at issue turns on the interpretation which we put upon the so-called "stem" or peduncle of the *Pedicellinidæ*. In my view it is not an element of the zoarium at

\* "Untersuchungen an Seebryozoen," Zool. Anzeiger, nos. 317 u. 318 (1889).

† "Aussi je n'admets pas la classification proposée par Th. Hincks pour les Pédicellines: les genres en sont établis non sur la forme de la zoécie ni sur les caractères zoéciaux, mais sur le pédicelle de la zoécie" ('Mission Sc. du Cap Horn,' p. 6).

all, but an integral part of the zoëcium. Dr. Jullien, in the passage quoted below, speaks of it as something absolutely distinct from the zoëcial structure; but he must have forgotten the investigations of Salensky\*, Vigelius †, and others, and the conclusive evidence afforded as to its morphological significance by the relation which has been demonstrated between it and the "*Pedicellina*-cup" or "crown." As Vigelius has clearly shown, the *Pedicellina*-cup is not the mere "equivalent of a polypide," but "the homologue of a 'polypo-cystide,' of which the stalk constitutes an integral part." He adds:—"In ähnlicher Weise habe ich auch den Körperbau von *Barentsia* aufgefasst." It is quite unnecessary to repeat here the admirable demonstration of the homologies upon which this interpretation of the *Pedicelline* structure is based, which we have from the authors to whom I have just referred. Their writings are accessible to the student of the *Polyzoa*. It may be added that Nitsche, who adopted a somewhat different theoretic view of the *Pedicelline* cup, was prepared to regard the peduncle (and also the stolon) as homologous with the zoëcium of the *Ectoprocta*. Long ago Allman ‡ anticipated to some extent the conclusions of recent investigators respecting the nature of the peduncle, regarding it as homologous with the posterior part of the cell in the unstalked forms of *Polyzoa*. His prevision is sustained by the results of the later research.

The genus *Barentsia*, then, is founded on distinctly *zoëcial* characters, and as representing an important modification of the *Pedicelline* type has every claim to a place in our system. If its validity is challenged it must be on different grounds from those on which Dr. Jullien relies.

As I have remarked in a previous portion of this paper, there is hardly any serious difference of opinion now as to the true *basis* of the classification of the *Polyzoa*, although we have not yet determined with certainty the most significant elements of the zoëcial structure, as indications of genetic affinity. We have reached a stage, as it seems to me, in which there is need not so much of large schemes of reconstruction as of patient investigation and the quiet accumulation of data, which sooner or later must open the way for us to a true apprehension of the order of nature. Meanwhile

\* "Etudes sur les Bryozoaires Ectoproctes," par M. Salensky, Ann. d. Sc. Nat. 6<sup>e</sup> sér. Zool. t. v. (1877), article no. 3.

† 'Die Bryozoen, gesammelt während der dritten u. vierten Polarfahrt des Willem Barents, in den Jahren 1880 u. 81,' von Dr. W. J. Vigelius, pp. 89, 90.

‡ 'Freshwater *Polyzoa*,' p. 22.

there is no doubt room for critical revision of the details of the current classification and for such readjustment as may be rendered necessary by our increased knowledge of specific forms and may tend to make it a more complete expression of its fundamental principle. And I may say in passing that I am very sensible of the service which Dr. Jullien has rendered by his enthusiastic and uncompromising loyalty to that principle, though I am unable to accept the special scheme of classification which he has associated with it.

To Dr. Koschinsky we are indebted for a valuable critique on a number of Cheilostomatous genera, in which he suggests some modifications of the existing groups and constitutes a number of new ones.

Some of the changes which he proposes seem to me to be in every way worthy of consideration. The enormous increase in the number of described species within the last few years would alone render some revision of the genera absolutely necessary. We are now in a much better position for determining the precise value of the characters employed in diagnosis, and have a much larger knowledge of the modifications of the generic types. A group which might seem sufficiently isolated and distinctive, when represented by only two or three species, in which the diagnostic characters are clearly and strongly marked, will present a very different aspect when it includes a multitude of forms, amongst which the common characters may have been more or less obscured and variously affected by ceaseless modification.

As our knowledge widens the lesson is pressed upon us with added force that we cannot isolate plots of the great genealogical network and shut them up within hard-and-fast lines, but must be content with a large amount of indefiniteness in our system, in view of the infinitely varied and complex relationships of organic life.

While I am unable to accept all Dr. Koschinsky's criticisms, I freely admit that there is much force in many of them and that he has established a case for the reexamination and revision of some of the existing groups.

## Section 2. Family *Cribrilinidæ*, Hincks.

Syn. Fam. *Costulidæ*, Jullien, Bull. Soc. Zoologique de France, t. xi. (1886).

In his paper entitled "Les Costulidées, nouvelle Famille de Bryozoaires," Dr. Jullien proposes a new classification of the forms which have hitherto been ranked in the family *Cribrilinidæ*, Hincks, including the genera *Membraniporella*,

Smitt, and *Cribrilina*, Gray. He contends that this family has no claim to stand, as it is incorrectly defined ("mal définie"), and accordingly he has cancelled it and substituted for it his family Costulidées, from which, as he defines it, the genus *Membraniporella* is excluded. The capital error therefore in my definition of the Cribiline family, according to Dr. Jullien, is that I have made it wide enough to contain the latter genus. For this he condemns and abolishes it.

Now even if his view were correct, which I hope to show that it is not, it is more than questionable whether there would be any sufficient ground for displacing a well-established family name and adding a new one to our already overburdened nomenclature. Usage is certainly against the course which Dr. Jullien has taken; and though the common practice may not be absolutely the best, it may be wiser to recognize it than to unsettle our nomenclature and enlarge the wearisome synonymy which is the reproach of systematic natural history. In the present case, if Dr. Jullien's view were correct, the retention of the family with an amended diagnosis, accompanied by a proper notification of the change, would do no wrong to the author of it and would certainly be in the interest of the student\*.

But it is unnecessary to discuss this question here, as I am not prepared to admit that the genus *Membraniporella* is an alien in the Cribiline family. Dr. Jullien refers it to the *Membraniporidae*. He says, "Cependant les *Membraniporella* sont encore des Membraniporidées, toutes leurs espèces n'ont pas leurs épines absolument soudées sur la ligne médiane de la zoécie : ce qui les différencie énormément des *Cribrilina*, où la soudure est non seulement complète sur la ligne médiane, mais où on voit encore de petits trabécules, qui soudent entre elles les épines principales. Les *Membraniporella* sont les Membraniporidées les plus élevées, et ne doivent peut-être pas être détachées de cette famille" ('Les Costulidées,' pp. 1, 2).

Upon this I remark first of all that I cannot assent to Dr. Jullien's statement that there are species of *Membraniporella* in which the (modified) spines are not soldered together along the median line. The type of Smitt's genus is *Membrani-*

\* In support of his view Dr. Jullien has adduced an aggravated case in which names have been changed and misapplied in defiance of all law and custom ('Mission Sc. du Cap Horn,' Bryoz. p. 4). For such there is nothing to be said. But to deal with such cases and others of the same class, and to revise our system in harmony with Dr. Jullien's dictum, "un genre doit rester tel qu'il a été établi par son auteur," would be to revolutionize the nomenclature of the Polyzoa, and it is more than probable that we should find the cure to be worse than the disease.



*pora nitida*, in which the extremities of the ribs are closely and permanently united, so as to form a distinct median line. This is an essential character of the only genus *Membraniporella* which we know, and it is an essential character of the Cribiline family. Forms in which it is wanting must be placed elsewhere.

Dr. Jullien regards the *Membraniporellæ* as the highest of the *Membraniporidæ*; to me they are the lowest of the *Cribrilinidæ*. Let me say at once, however, that I am in perfect agreement with him when he urges that the true *Membraniporæ*, *Membraniporella*, and the *Cribrilinidæ* are forms which "s'enchaînent et pourraient à la rigueur ne former q'une seule famille." No doubt they are terms in an evolutionary series, connected by many transitional links, and on merely genealogical grounds might well be gathered into a single group. But the question will arise, Why should we stop here? for we shall probably find that the group is not an isolated thing, but touches other groups at many points, and that the family relationship is wide and far-reaching. If we are to have any *system* at all embracing a number of limited groups the latter must represent the more marked stages in the evolutionary process, the new structural departures, as it were, and the boundaries traced around these groups must be treated rather as imaginary lines, drawn for the sake of convenience, than as actual and abiding partition-walls\*. For always and in all directions our "distinctive characters" will be gradually changing their aspect and significance, according to the method of nature. Only in this way can we make our classifications correspond with the actual plan of organic life. The Cribiline family, in my judgment, has been rightly constituted to represent an important morphological advance in the Membraniporine tribe.

Now if we examine this tribe, we find in the first place a series of forms (genus *Membranipora*) in which the zoöcial aperture is wholly closed in by the primitive membranous covering, and there is no trace of a calcareous front-wall; in some cases the margin of the aperture bears a number of spines or spinules, which may possibly have to some extent a protective function, in others the spines are more massive and bend in over the aperture, so as to form a rude kind of roofing. In some species they are altogether absent. The

\* "In all our classifications of a truly natural group, where the different species will be arranged into more or less complete series, we must be prepared for seeing the limits between the divisions fading away, especially when the developmental changes are known." (Smitt, 'Floridan Bryozoa,' part 2, p. 41.)

orifice, through which the polypide issues from its cell, is a simple semicircular opening in the membranous wall, which is closed by a movable valve.

In another section we meet with an important modification and adaptation of the spinous appendages, resulting in the formation of a true roof-like structure, which gives a new character to the zoëcium and marks a great advance upon the slight protection afforded by a number of isolated spines. The spines are now represented by broad flattish ribs, which bend in over the aperture, those on each side meeting in the centre of the cell, where their free extremities are firmly soldered together. Laterally they remain separate, and the fissures between them are filled in by the primitive membranous wall. This group is the genus *Membraniporella* of authors. In it a well-framed protective covering, in great part calcareous, has been superadded to the simpler structure of the true *Membraniporæ*—a most significant morphological advance.

If we proceed a step further we find that in other kindred forms the ribbed front-wall is strengthened and consolidated by the addition of small lateral offsets (calcareous) from the ribs, which stretch across at short intervals from one to the other, and so bind them together and strengthen the fabric. The spaces between these intercostal supports are usually occupied by a line of pores. The genus *Cribrilina* has been founded for this well-marked structural type; and the two last-named genera constitute the family *Cribrilinidæ*, as I have defined it, of which the distinguishing character is that the zoëcia possess a ribbed calcareous front-wall, more or less consolidated, a character which has no existence amongst the true *Membraniporæ*.

Dr. Jullien, as we have seen, affirms that the genus *Membraniporella* includes species which have a calcareous front-wall and others in which the marginal spines are not absolutely soldered together on the median line ('*Costulidées*,' p. 1). On what characters then, we may ask, is the genus founded, and by what criteria is it distinguishable from *Membranipora*? By admitting that species which have the spines thoroughly united along the median line may mingle in the same group with others in which they are not "absolutely" united (that is, I presume, not really united at all), he virtually destroys the foundation on which the family *Cribrilinidæ* has hitherto rested. What remain, then, as the distinctive features of his own *Costulidæ*? The ribbed calcareous front-wall is also a character of his *Membraniporidan* genus *Membraniporella*. The small processes ("trabecules") given off

from the sides of the ribs, and binding them one to the other, form in fact the only distinguishing character of the group. It is hardly necessary to say that, however interesting as a step in the development of the front-wall, this detail has no special significance and certainly no claim to be adopted as the basis of a family group.

But, as I have pointed out before, the genus *Membraniporella* is founded on a well-marked type-form, *M. nitida*, Johnston, in which the spines are transformed into ribs and are no longer isolated, but elements of a well-compacted protective covering, which roofs in the front of the cell. It is at this point in the evolutionary series that a new family may be legitimately instituted, not to break the natural continuity of development or obscure the natural relationships, but to mark the morphological advance.

I am compelled therefore to reject Dr. Jullien's proposed change and to maintain the family *Cribrilineidæ* as at present constituted.

It must be remembered that the front-wall in this group is by no means homologous with the front-wall as it exists in most of the Cheilostomatous families. Its mode of growth is different, its constituent elements are different. It is not a continuous extension of the cell-wall, but is formed by the adaptive modification of certain spinous processes which originate on the wall below the margin of the cell. Its function, like that of the solid covering characteristic of other families, is protective, but the two are built on different structural plans and bear different relations to the zoöcial organism. A clear indication of this important fact should be included in the diagnosis of the family.

In the course of a careful study of a large number of Cribriline species which I have lately made one or two interesting points have been determined, which may be briefly noticed:—

i. *Modification of the Spines.*—In the early stages of the Cribriline cell the marginal spines, which are to form the front wall, present the same appearance as the corresponding parts in a *Membranipora*.

They are (in *Membraniporella nitida*) slender and suberect, but ultimately bend in over the aperture, and increase considerably in width by the secretion of calcareous matter round the edges. In this way a broad flattish rib is formed, in the centre of which the original spine is traceable. This transformation of the spine is constant throughout the family.

ii. *The Orifice and Operculum.*—The orifice amongst the *Cribrilineidæ* is formed by the two uppermost ribs, which are often stouter than the rest and which shut off and enclose the

terminal portion of the aperture. It is not therefore strictly homologous with the orifice of the other Cheilostomata, which is due to an arrest of the calcification of the front-wall.

There is some variation in the position and character of the two ribs which close in the orifice. In *C. crassicosta*, Hincks \*, two large stout spines originate one on each side at the top of the cell, and bend round to the front, in the centre of which they unite, inclosing a space of which the cell-wall is the upper boundary. These spines are usually very broad and represent the peristome of the solid-walled Cheilostomata. More commonly the two uppermost ribs of the costate roof, which originate at some distance from the upper extremity of the cell, constitute the boundary of the orifice in front (the lower margin), whilst the cell-wall encloses it at the sides and top. These two marginal ribs are thick and solid, and at the central point of junction the extremities frequently project and give a mucronate appearance to the front of the orifice. This is often very marked, as in *C. annulata*, Fabricius, and *C. furcata*, Hincks. Sometimes these marginal ribs do not meet exactly, and not unfrequently they remain permanently disconnected; sometimes the extremities seem to exceed the required length and are forced outward; usually a small cleft may be detected, which marks the point of junction.

Dr. Julien takes exception to my retention of those forms with a *quasi*-mucronate lower margin amongst the *Cribrilinida*, and considers that I am false to the principles on which my classification is founded in not removing them to the genus *Mucronella*. That I have not done so he seems to regard as an admission that the structure of the orifice is essentially a character of inferior value as compared with the front-wall of the zoecium, which he has adopted as the most important for classificatory purposes.

I do not propose at present to discuss the validity of the mucronate margin in *Mucronella* as a generic distinction, but merely to point out that it is by no means the structural equivalent of the two ribs which close in the orifice of the *Cribrilinida*. The structures are totally dissimilar in their morphological significance. The occasional and variable prominence (for it is by no means constant where it occurs) in certain species of *Cribrilina*, at the point of junction of the ribs which compose the lower margin, and which is in fact

\* This is a very distinct form from the St. Lawrence, characterized by having a small number of very massive ribs, which are separated by wide intervals. In this species the protective covering is reduced to a minimum. For description and figure see a paper on "The Polyzoa of the St. Lawrence," 'Annals' for March 1888, p. 216, pl. xiv. fig. 5.

the result of the junction, is not comparable with the solid mucronate rising of the margin (itself an integral part of the cell-wall) in the *Mucronella*. I am perfectly justified therefore in not assigning a like systematic value to structures which differ entirely in their origin and their relation to the other elements of the zoëcium, and which have really nothing essential in common.

At the same time in the family *Cribrilinide* I regard the structure of the front-wall (or costate roof, as it may be called, to distinguish it from the front-wall proper) as the dominant character and much more significant than the orifice. It is the record of the evolutionary changes through which the Membraniporine zoëcium has passed in one of the family lines, it tells the story of its gradual modification with a completeness that leaves little to be desired, and enables us to mark out a systematic group which is absolutely natural. But though we assign this rank to the unique protective covering of the Cribriline cell, it by no means follows that the ordinary Cheilostomatous front-wall is universally entitled to this distinction. The structure which replaces the latter amongst the *Cribrilinide*, as we have seen, is aberrant and exceptional and has a distinct evolutionary meaning.

It remains to be proved that the solid calcareous covering which we meet with in other groups has any *special* morphological value or presents characters which are available for the purposes of the systematist. Dr. Jullien has certainly not supplied any evidence so far in support of his new view to which much weight can be attached. In fact his case rests mainly on the assumption (baseless, as I have just shown) that my treatment of the *Cribrilinide* is virtually a renunciation of the principles which I have hitherto maintained. If we add to this his contention ('*Les Costulidées*,' p. 3) that the fact of his having observed in different species monstrous cells, destitute of orifice but with "a superb front-wall," is a proof of his doctrine "que l'orifice est moins caractéristique que la paroi frontale," we have the whole case. This is certainly to base the primacy of the front-wall amongst systematic characters on a very slender foundation, and will hardly warrant such confident statements as the following:—"Des différents faits que nous venons d'énoncer il résulte que la forme de l'orifice est un caractère d'une valeur inférieure, dominé par celui qu'on peut tirer de la paroi frontale, et que les genres *Schizoporella*, *Lepralia*, *Mucronella* établis par Th. Hincks doivent être rejetés comme mal caractérisés" \* ('*Les*

\* After this condemnation it is somewhat startling to read the following passage in the Cape-Horn Report:—"Genre *Lepralia*, Th. Hincks



Costulidées,' p. 3); and again, "En établissant la famille des Costulidæ, j'ai fait voir la faiblesse du caractère principal adopté par Th. Hincks, pour sa classification des Bryozoaires Cheilostomiens, consistant simplement dans la forme de l'orifice zoœcial\*, et j'ai établi la plus grande valeur caractéristique de la *frontale* (paroi). Cette appréciation m'oblige à rejeter tous les genres que l'auteur anglais a créé d'après la manière d'être de l'orifice, sans tenir compte de la disposition de cette paroi, et a bouleverser complètement les classifications admises jusqu'à ce jour. Je suis donc amené à définir de nouveaux groupements, pour l'établissement desquels je m'appuierai: 1<sup>e</sup>, sur la paroi frontale; 2<sup>e</sup>, sur la disposition des origelles; 3<sup>e</sup>, sur la forme de l'orifice; 4<sup>e</sup>, sur l'anatomie." ('Mission Sc. du Cap Horn,' p. 45.)

It is not my present purpose to examine at any length Dr. Jullien's scheme of a general classification of the Polyzoa †; but I venture to suggest that the time has not arrived for an efficient revision of our system and that the work of reconstruction (so far as it may be needed) should not be commenced until the foundations on which it is to rest have been thoroughly tested.

The dogma of the "front-wall," which Dr. Jullien would make the corner stone of his new structure, has not yet been subjected to a searching examination. In his system it is associated with the theory of the "origelles," which must certainly be regarded, to say the least, as still *sub judice*, and upon which the researches of Dr. Pergens have already thrown considerable doubt. It would be impossible to accept the proposed system, whatever its merits may be, in the present stage of inquiry; and with all respect for Dr. Jullien I must hold that it is undesirable in the interest of science to sweep away existing classifications and unsettle established nomenclature and remove old landmarks until the foundations of the new order that is to follow have been well and securely laid.

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(not Johnston, 1838), 1880. Cet ancien genre de Johnston a été entièrement bouleversé par Th. Hincks, et ne devrait plus exister aujourd'hui. . . . mais comme je comprends ce genre de la même façon que Hincks, je renvoie à sa définition." The genus is placed in the family Smittidæ, J. Jullien, the diagnosis of which is founded altogether on the structure of the zoœcial orifice.

\* This statement may be somewhat misleading. It is no doubt true that in my classification the structure (rather than the mere "form") of the zoœcial orifice is a primary character; but in a large proportion of cases it is associated with other significant characters, and where it has been employed alone it has been from the absence (as it seemed at the time) of other available diagnostics.

† See 'Mission Sc. du Cap Horn,' p. 7.

To return to the *Cribrilinidæ*. The history of the operculum in its relation to the orifice in this family is worthy of notice. We can trace the passage from the simple Membraniporidan stage, in which the operculum is a membranous valve closing a semicircular opening in the primitive wall, to the fully developed chitinous door, fitted exactly into the oral framework and moving on a kind of hinge. Amongst the *Membraniporellæ*—the lowest of the *Cribrilinidæ*—there seems to be a very slight modification of the Membraniporidan arrangement. The operculum (in *M. nitida*) is formed of delicate membranaceous material and is not enclosed by the orifice, as in a frame, nor does it work upon the denticular processes which act as hinges in so many of the Polyzoa. When it is thrown back it is suberect and leans against the lower margin of the orifice, rising from the membranous wall, which is depressed and lies at some distance below the arched ribs. When it is shut it is enclosed above and at the sides by the cell-wall, but is nowhere in contact with the ribbed roof of the cell. It lies on the primitive wall, as in *Membranipora*. The same structure is met with in some of the *Cribrilinæ*, as *C. annulata* and *C. punctata*; but in most of the species which I have examined (as in *C. hippocrepis*) the operculum is composed of stout chitinous material, is closely fitted to the shape of the orifice, the base being in contact with the lower margin, and in the present case works on lateral denticles placed one on each side. We are able to trace in this element of the structure, as in the general character of the zoecium, the progress of evolutionary change from the lower Membraniporidan to the higher Cribriline type.

In his family of the *Costulidæ* Dr. Jullien has instituted no less than twelve genera, of which eleven are new, exclusive of the *Steginoporidæ* of d'Orbigny, which he rightly includes in this group.

Of these genera a large proportion, in my judgment, are founded on trivial characters of no special significance, and cannot be maintained. The characters drawn from the "front-wall" especially are generally of the very slightest moment, some of them hardly of specific value. Those drawn from the "pores d'origelles" can hardly be estimated until we are in possession of the results of further investigations, but are probably of very secondary importance.

I have already given my reasons for holding that *C. hippocrepis*, Hincks, cannot be detached from the Cribriline group, on account of the structure of its zoecial orifice; but within this group I am inclined to agree with Dr. Jullien that it should stand as the type of a new genus.

This paper has assumed of necessity more of a controversial character than I could have desired. I trust that none of the evil spirit of controversy has found its way into what I designed to be a purely critical discussion in the interest of scientific truth.

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XIII.—*On a new Species of Tit.*

Dehesa de Cologan,  
Puerto de Orotava,  
Tenerife,  
1st December, 1889.

*To the Editors of the Annals and Magazine of Natural History.*

GENTLEMEN,—I enclose you the description of a new species of Tit that I have just discovered in the island of El Hierro, the most southern and western of the Canarian Archipelago. It is abundant in the pine-forest there.

Yours faithfully,

E. G. MEADE-WALDO.

*Parus ombriosus*, sp. nov.

*P. Paro tenerife* similis, sed fortior et robustior; tergo toto olivaceo-viridescente, nec caeruleo; tectricibus alarum viridibus, majoribus angustissime albo terminatis: subtus citrinus, *P. tenerife* similis. ♀ haud a mari distinguenda.

Named from the ancient Moorish name (Ombrios) of the island of Hierro, where alone it has been found.

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XIV.—*How does the Ugimya-Larva imbed itself in the Silkworm?* By Dr. FR. MEINERT.

THE 'Bolletino della Società Entomologica Italiana,' anno secondo (1870), contains two papers concerning the *Ugimya sericarie*. One is a little note only ("Sull' insetto Ugi," pp. 134-137) by Rondani, mentioning the larva and pupa of a Tachenarian which Mr. Menegazzi had discovered in Japan making its way out from the cocoon of a silkworm. In conclusion Mr. Rondani (p. 137) gives a description of the larva